

Palo Verde Nuclear Generating Station  
Sequence of Events  
on Monday, June 14, 2004

Generation:

Palo Verde Unit-1  
Palo Verde Unit-2  
Palo Verde Unit-3  
Redhawk Steam Turbine 1  
Redhawk Combustion Turbine 1A  
Redhawk Combustion Turbine 2A

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07:40:55.747 Fault #1 inception  
Fault #1 type = C-N  
Fault #1 cause/location = Phase down reported near 115th Ave. &  
Union Hills (WW-LBX Line)

07:40:55.814 4.0 cycles after fault #1 inception  
WW1126 opened (LBX / PPX 230kV crossover breaker)

07:40:55.822 8.5 cycles after fault #1 inception  
LBX1282 opened (Westwing 230kV Line)

07:40:56.115 22.1 cycles after fault #1 inception  
AFX732 & AFX735 opened (Westwing 230kV Line)

1 ✓ 07:40:56.122 22.5 cycles after fault #1 inception  
YP452 & YP852 opened (Westwing 525kV Line)

07:40:56.136 23.3 cycles after fault #1 inception  
WW1426 & WW1522 opened (Agua Fria 230kV Line)

2 ✓ 07:40:56.142 23.7 cycles after fault #1 inception  
WW856 & WW952 opened (Yavapai 525kV Line)

07:40:56.165 25.1 cycles after fault #1 inception  
DV322 & DV722 & DV962 opened (Westwing 230kV Line)

07:40:56.172 25.5 cycles after fault #1 inception  
WW1726 & WW1822 opened (Deer Valley 230kV Line)

07:40:56.196 26.9 cycles after fault #1 inception  
RWYX482 & RWYX582 & RWYX782 opened  
(Westwing 230kV Line)  
(Waddell 230kV Line)  
(230/69kV Transformer #8)

A/16

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07:40:56.515 46.1 cycles after fault #1 inception  
WW1222 opened (Pinnacle Peak 230kV Line)

07:40:56.548 48.1 cycles after fault #1 inception  
SC622 & SC922 & SC262 opened (Surprise 230/69kV  
Transformer #4)

07:40:57.549 108.1 cycles after fault #1 inception  
SC1322 opened (Westwing 230kV Line)

07:40:58.339 155.5 cycles after fault #1 inception  
RIV762 opened (Westwing 69kV Line)

07:40:58.372 157.5 cycles after fault #1 inception  
HH762 opened (Westwing 69kV Line)

07:40:59 (EMS) WW2026 & WW2122 opened  
(Westwing 230/69kV Transformer #11 - High Side)

07:40:59.272 211.5 cycles after fault #1 inception  
WK362 opened (Westwing 69kV Line)

3 ✓ 07:40:59.489 224.5 cycles after fault #1 inception  
HAAX935 & HAAX938 opened (Hassayampa - Arlington 525kV  
Line)  
(Time stamp provided by SRP)

07:41:00 (EMS) WW862 & WW962 & WW1362 opened  
(Westwing 230/69kV Transformer #11 - Low Side)

07:41:00.392 278.7 cycles after fault #1 inception  
WW752 opened (South 345kV Line)

4 ✓ { 07:41:01 (EMS) RWP-CT1A opened (Redhawk Combustion Turbine 1A)  
07:41:01 (EMS) RWP-ST1 opened (Redhawk Steam Turbine 1)  
07:41:01 (EMS) RWP-CT2A opened (Redhawk Combustion Turbine 2A)

07:41:01.982 Fault #1 type changed = B-C-N

07:41:02.154 Fault #1 type changed = C-N

07:41:02.799 Fault #1 type changed = B-C-N

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07:41:03.966 493.1 cycles after fault #1 inception  
SC562 opened (McMicken 69kV Line)

9 07:41:04 (EMS) PSX832 closed auto  
(Perkins Cap-Bank Bypass)

07:41:05.373 577.6 cycles after fault #1 inception  
MQ562 opened (McMicken 69kV Line)

10 07:41:07.851 12.104 seconds after fault #1 inception  
PLX972 & PLX975 opened (Hassayampa 525kV Line #2)  
(Time stamp provided by SRP)

11 07:41:07.875 12.128 seconds after fault #1 inception  
PLX982 & PLX985 opened (Hassayampa 525kV Line #3)  
(Time stamp provided by SRP)

12 07:41:07.880 12.133 seconds after fault #1 inception  
PLX942 & PLX945 opened (Hassayampa 525kV Line #1)  
(Time stamp provided by SRP)

07:41:08.104 Fault #1 type changed = A-B-C-N

13 07:41:10.445 14.698 seconds after fault #1 inception  
NV1052 & NV1156 opened (Westwing 525kV Line)

14 07:41:10.456 14.709 seconds after fault #1 inception  
WW556 & WW652 opened (Navajo 525kV Line)

07:41:12 (EMS) WW424J opened (Westwing 230kV West Bus Reactor)

15 07:41:13 (EMS) HAAX912 & HAAX915 opened (Palo Verde 525kV Line #3)

16 07:41:13 (EMS) HAAX922 & HAAX925 opened (Palo Verde 525kV Line #2)

17 07:41:13 (EMS) HAAX932 opened (Palo Verde 525kV Line #1)

18 07:41:20.005 24.258 seconds after fault #1 inception  
PLX992 opened (Devers 525kV Line) (PLX995 out-of-service at  
this time)  
(Time stamp provided by SRP)

19 07:41:20.113 24.366 seconds after fault #1 inception  
PLX932 & PLX935 opened (Rudd 525kV Line)  
(Time stamp provided by SRP)

*open  
conducted  
sensing =>  
senses open  
pole on 9.76  
8th => (Phase  
differential)  
8th*

*Current differential  
Protection relay.  
Sense 20% rejected  
(operate 7 seconds after  
the fault)  
After line to Hassayampa*

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- U 07:41:20.864 25.117 seconds after fault #1 inception  
PLX912 & PLX915 opened (Westwing 525kV Line #1)  
(Time stamp provided by SRP)
- 1 07:41:20.873 25.126 seconds after fault #1 inception  
WW1456 & WW1552 opened (Palo Verde 525kV Line #2)
- 8 07:41:20.874 25.127 seconds after fault #1 inception  
WW1156 & WW1252 opened (Palo Verde 525kV Line #1)
- 1 07:41:20.895 25.148 seconds after fault #1 inception  
PLX922 & PLX925 opened (Westwing 525kV Line #2)  
(Time stamp provided by SRP)
- 3 07:41:21 (EMS) RUX912 & RUX915 opened (Palo Verde 525kV Line)
  
- 07:41:23.848 28.101 seconds after ~~fault #1 inception~~  
PLX988 opened (Palo Verde Unit-3)  
(Time stamp provided by SRP)
  
- 07:41:24.280 System Frequency = 59.514 Hz  
(Measured at APS Reach Substation)
  
- 07:41:24.641 28.894 seconds after ~~fault #1 inception~~  
PLX918 opened (Palo Verde Unit-1)  
(Time stamp provided by SRP)
  
- 07:41:24.652 28.905 seconds after ~~fault #1 inception~~  
PLX938 opened (Palo Verde Unit-2)  
(Time stamp provided by SRP)
  
- 07:41:34.615 38.868 seconds after fault #1 inception  
Fault #1 cleared
  
- 07:42:22.773 System Frequency = 59.770 Hz  
(Measured at APS Reach Substation)

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*Have Rec'd test delay on  
line => disable negative  
sequence portion of relay*

*\* IF not opened => other lines may not have opened.  
may have isolated at 230kV. -> fault would have burned thru.*

*\* PV Gen Line neg. sequence. -> fault found to 3rd fault.  
never started f. news. circuit divided by several pathways/*